Northern Shenandoah Valley ITS- Public Safety Initiative

FINAL REPORT

Submitted to:

Northern Shenandoah Valley
Regional Commission

Submitted by:

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1. SUMMARY

This report summarizes the efforts of The Pennsylvania State University's Applied Research Laboratory (PSU/ARL) to conduct field tests using a handheld data collection system to enable emergency medical personnel (EMS) to collect and transfer patient information to the hospital emergency department (ED). The expected benefits of these efforts are improved overall patient care; streamlined administrative reporting; and an increase in overall accuracy and efficiency in EMS operations. The organizations involved with the evaluation program are The City of Winchester in Northern Shenandoah Valley, EMS responders from New Market and Strasburg Rescue Squads, Winchester Medical Center and Shentel Shenandoah Telecommunications, Inc., all located in the state of Virginia.

2. INTRODUCTION

PSU/ARL has been involved with field trials of a similar data collection system in Pennsylvania using handhelds or more commonly recognized as personal digital assistants (PDAs). The efforts in Pennsylvania, supported by The Pennsylvania Department of Health Emergency Medical Services Office, studied the use of handhelds and their role in the overall improvement of emergency medical response through more effective, timely collection and handling of patient data. This experience in Pennsylvania formed the basis for the field trials conducted in Virginia (Ref: http://www.arl.psu.edu/areas/patrauma/patrauma.html#PRESENTATIONS).

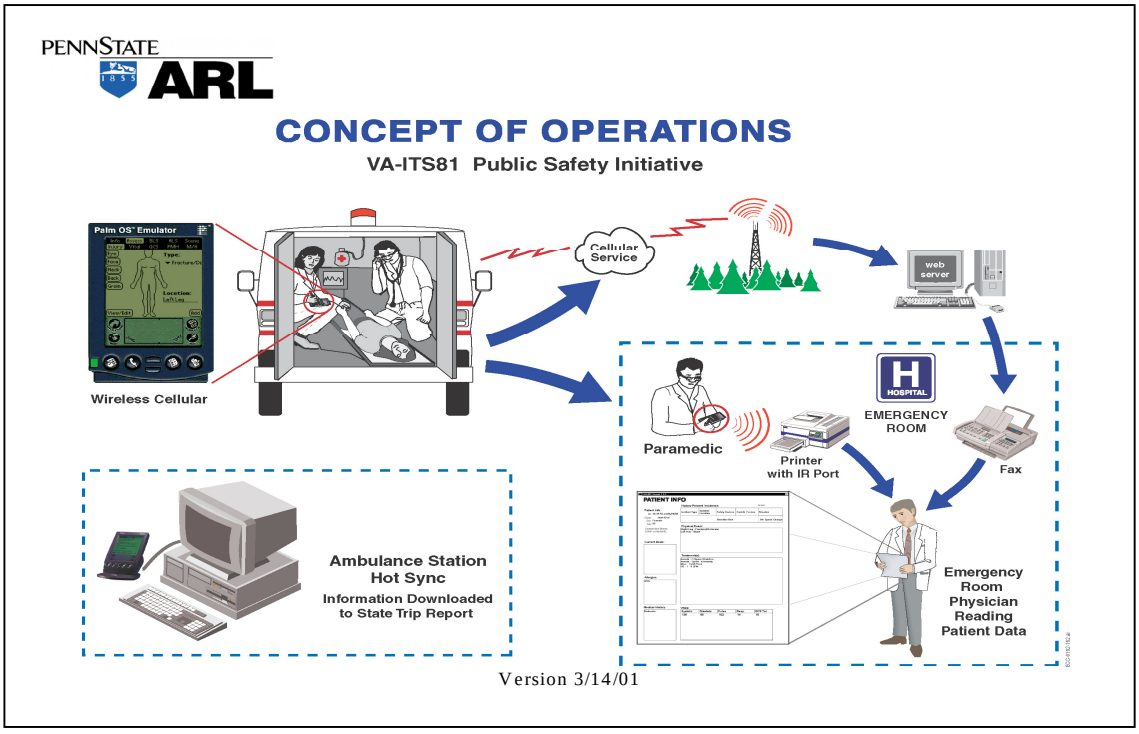

Figure 1

The concept of operations of the system is shown in Figure 1 above. The system is designed to serve and benefit several different groups of people. Emergency room physicians are in need of patient information on arrival or better yet, before the patient arrives at the hospital. EMS providers need improved and streamlined methods for state and internal reporting. Virginia Department of Health (VDH) has a need for more timely and accurate data. Finally, the Virginia Department of Transportation (VDOT) has the potential to use the data to improve accident response mechanisms. All groups have needs and the handhelds maybe a possible solution.

3. FIELD OPERATIONAL TRIALS

3.1. Field Trial Implementation

PSU/ARL performed the following engineering functions necessary before implementing the system into the field:

1. Determined the necessary data fields required by the VDH for Pre-Hospital Patient Care Reporting (PPCR).

2. Made the necessary modifications to the handheld software and system software necessary to collect, transfer and manage the information. [Subcontractor, Med-Media, Inc., made modifications to existing R-EMStat and EMStat software to collect the VDH required information. R-EMStat is the application for the handheld and EMStat is the application used on the desktop and provides the VDH PPCR. The system was integrated and tested.]

3. Installed the system in the field involving both hardware and software setup. The hardware setup consisted of a desktop PC at the two rescue squad stations, New Market and Strasburg, and infrared-capable printers in the ED at the participating hospitals. The EMStat software was installed on the desktop PCs and R-EMStat was installed on the handhelds to be used by the participating EMS providers.

4. Explained and demonstrated the functionality of the hardware and system applications to the participating EMS providers through an organized training session. The training session consisted of an overview of the desktop application EMStat and hands-on training of the handheld basics and the application R-EMStat. The participants were encouraged to practice on their own and to become familiarized with the applications.

3.2. TASK PERFORMANCE

3.2.1. Task 1 - Design

Task 2 - User Requirement

The system was designed integrate many of the features that had been tested in previous field trials in the Pennsylvania study. The changes that needed to be

incorporated in this system were those relating to VDH requirements. For example, a signature sign-off by the attending ED doctor at time of patient hand-off is required; therefore, a place for the attending ED signature sign-off needed to be incorporated on the printed report.

3.2.2. Task 3 - Integration

Once the design incorporated the user's requirements, the individual components of the system were integrated and tested. The individual components consisted of the database structure to be used to capture the VDH data; modified R-EMStat and EMStat applications to be used on the handheld and desktop computer respectively; and conduits to integrate the handheld and desktop applications. Once the system was tested, the hardware and software were installed at New Market and Strasburg. Printers were installed in the ED at the participating hospitals in the Shenandoah Valley. The functionality for fax transmission of the data from the handheld to the ED was also established using commercial wireless communications provided by Shentel Shenandoah Telecommunications, Inc.

3.2.3. Task 4 - Field Trials

Training on the system for the field users was completed at the New Market Rescue Squad station. Handhelds with R-EMStat were given to the field users at this time. The field users were trained on the usage of the handheld and R-EMStat application. The *HotSync* (a sophisticated method of linking a handheld computer and a desktop computer to transfer information between the two computers) functionality was explained and demonstrated for the users. The field users were given an overview of the EMStat desktop application and how the HotSync functionality worked between R-EMStat and EMStat. The field users were instructed to practice on the handhelds to become more familiar with the hardware and software.

Besides the handhelds, three cellular phones that have a handheld device built-in it were used as well to test wireless communications to the ED. The field users who were using the cellular phones could enter patient information and wirelessly send the collected information to a fax machine located in the ED. The phones also had the HotSync functionality and could be used with the desktop application, EMStat.

3.2.4. Task 5 - Assessment

Task 6 - Recommend Product Implementation

The assessment consisted of user acceptance, timesavings, functional savings and cost savings. It is hard to quantify some of these measures. Most of the assessments were completed through focus group interviews and written surveys of the field users during the field tests. Through the interviews, the information collected from the field users will help to make recommendations for product implementations.

4. FINDINGS

The findings presented are the field user's responses to a survey distributed to the users and observations observed during the field trials.

4.1. Field User's Responses (See Appendix A for complete data)

HARDWARE

Positives:

- Touch screen
- Organizational tool for collecting patient information

Negatives

- Screen is too small and contrast cannot be adjusted enough for night use
- Complex
- Works intermittently

SOFTWARE

Positives:

- Able to enter a lot of patient information
- Easy to find patient information
- Good tool

Negatives

- Too many fields to complete
- Flow of entry using handheld software is inefficient
- ALS information does not printout

HOTSYNC CAPABILITY

- Liked concept
- Works well but sometimes there were failures
- Not all of the information is transferred to EMStat or on the printed report
- Easy to use

HANDHELD USAGE

- Most used the handheld during post-call, some used it in-the-field and rarely was it ever used pre-call

WHAT PREVENTED THE USE OF THE HANDHELDS

- Takes too much time for entry of data
- Not enough time to enter data
- Maneuvering through screens and fields on the handhelds
- Handheld size
- Manpower on unit
- Lack of ALS information being printed on report
- Type of Call
  - Cannot be used easily on a Trauma call

- Can be used for Medical calls

INFRARED PRINTING
- Some problems with Rockingham Memorial hospital printer
- Most field users utilized this feature and liked it

OTHER FEATURES DESIRED
- Place to enter summary and print summary at ED
- Patient history report
- Printing of ALS interventions

OTHER APPLICATIONS USED ON HANDHELD
- EMS Field Guide was used by three users

WIRELESS CELLULAR PHONE USERS
- Not enough time to get data entered and send patient information wireless (short ETAs)
- Issues with connectivity

4.2. Observations

The focus group approach of evaluation was taken because of the physical distance between the field test site and PSU/ARL. Several meetings were held where field users were given the opportunity to give feedback on the project. Most of their responses were reflective of their survey results given above.

Prior Technical Experience: Field users who had experience with computers and electronic devices were less apprehensive to use the handhelds. If the user had no experience with computers, they became very frustrated when using the handheld. There is a learning curve with using the handheld devices and is longer for those without prior experience with computer technology. The best way to become more familiar and experienced user is to practices on the handhelds.

Volunteer EMS Providers: In general, there was a noticeable delay and lag time associated with introducing and using an electronic system within the volunteer community as compared to the paid EMS providers we have worked with in Pennsylvania. Volunteers do not respond to the number of calls responded by paid EMS providers. Therefore, they do not get as much exposure to using the handhelds on a daily basis. Another issue with being a volunteer is that most of the time when responding, the users were in street clothes that usually do not have convenient pockets to hold the handhelds.

Hardware Issues: The handheld device used during the field trials was the Palm 100. These devices seemed to have a higher failure rate then other models. If there was a hardware failure, time was required to get a replacement and the individual would be without a handheld device for several days. Some users said the screen was too small and the contrast of the screen was poor for night use. The handhelds included Graffiti

writing software as the primary system for entering text and numbers. Users said the strokes for numbers was easy to master but the text strokes were more complex. Keyboards were provided for use but to use them, a flat surface was needed.

Some users had a wireless cellular phone. The wireless cellular phones have a Palm-like interface but also can be used as a cellular phone and wireless modem. An issue with the wireless cellular phones was their battery life. Even though the battery seemed to be completely charged, the field users could turn it on the next day and it would be completely dead. When this happened, the R-EMStat software would have to be re-installed and re-configured. The wireless cellular phones had the capability to send faxes containing patient information to the ED. To be able to do this, a server had to be setup at the wireless service provider (Shentel Shennadoah Telecommunications, Inc.) to service these request. The wireless cellular phone users had difficulty getting a connection to the server. There was an issue with the fax software that could not be resolved.

Software Issues: Most users did not find the software hard to use on either the handhelds or the desktop. The only issue was location of where to enter information in R-EMStat and EMStat applications. As the with any software application, the more the software is used, users will become more comfortable with how to use the software.

Because of these issues mentioned above, there was some delay getting the study underway. Therefore, the field trials lasted three months and this was not enough time for the users to really gain the necessary experience.

5. RECOMMENDATIONS

The findings for the study lead to the following recommendations. The system has promises but the initial group of users did not have the needed computer skills and did not respond to enough calls to become familiar and experienced on the system. In future studies, paid, full-time EMS providers should be selected as field users and the length of the study should be at least six months in length. If volunteer participants are included in the study by design, adequate time for computer skill training is necessary before the implementation in the field. Overall, the length of the study should be longer to gain a better understanding of the pros and cons of such system.

A different handheld model should be used to resolve some of the failures experienced with the model used in the study. The other thing that would be addressed is the screen size and darkness. A model with a color screen may have better contrast for night use.

Training sessions and refresher courses should be given throughout the period of the study to encourage the use and possibly shorten the learning curve. The training sessions should be a review of the operations of the system but should also provide feedback from users of issues that they maybe having with the system. These should

be lead by experienced, technical personnel who are involved with study and within a close proximity to the field test location.

As with new technology, the first users are the ones who make it better for future users. The field users had a lot to learn in a short period of time. In future studies, some of the mentioned recommendations should be incorporated and better measures of patient outcomes need to be determined to quantify success of using technology.